AEROSOL AND AIR FILTER THERAPY*

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Numerous factors determine where aerosolized particles will be deposited in the tracheobronchial tree such as size, shape, density, and dose of the particles as well as the age, sex, pattern of breathing, and pre-existing disease of the subject.[1,2] For example, animal models show that the sensitivity to ascaris antigen may vary from animal to animal by a factor of 10,000. Exercise and increased activity change the deposition of particles as does a switch from nose to mouth breathing. Slow tidal breathing deposits particles throughout the parenchyma while quick, deep breaths (with a high flow rate) favor deposition in the larger airways.

SYMPATHOMIMETICS ADMINISTERED BY INHALATION

Aerosolized bronchodilators have fewer side effects than comparable orally administered agents. Aerosolized bronchodilators such as isoproterenol or epinephrine, diluted with sterile water or saline and delivered by either pump (e.g., Maxi-Myst) or bulb nebulizer, frequently provide instant relief from bronchospasm. Intermittent positive pressure breathing offers no additional benefit over the other delivery systems. Commercially available products containing the controversial inert freons are more susceptible to abuse because of their convenient size. Such beta 2 stimulators as isoetharine and metaproterenol, which are purported to avoid many of the cardiac side effects and have a longer duration of action, have gained in popularity. Albuterol (salbutamol) is not yet available in the United States. The usual dosage is two inhalations up to every four hours. However, in a study comparing increasing doses of albuterol with

*Presented as part of a course, *Review of Procedures Used in the Practice of Allergy*, presented by the Columbia University College of Physicians and Surgeons and the American Academy of Allergy at the New York Academy of Medicine November 5-7, 1980.

isoproterenol, we found increasing bronchodilation with increasing doses (up to eight inhalations) as compared with isoproterenol.[3,4] There were no side effects even at the highest dose and bronchodilation lasted significantly longer.

ATROPINE SULFATE

Atropine is not a new drug for asthma. Its use dates back to the early allergists who considered asthma a yin-yang between the sympathetic and parasympathetic systems. Present knowledge suggests that they were not all wrong considering how relatively little they knew then. The parasympathetic system is very much involved in asthma, as Nadel, Gold, and Kaliner[5,7] have shown dramatically in recent times.

Atropine sulfate does not appear to be efficient when given by injection. It is an excellent bronchodilator in a great many asthmatics, but by no means all of them, when given by inhalation. Side effects, in our experience, when given by inhalation have been negligible: a dry mouth for a short time is the only consistent effect noted, and then not all that frequently. It should be noted that *inhaled* atropine sulfate is *not* an approved use, even though it is an approved drug by the Food and Drug Administration, and hence should be considered for children or adults where conventional procedures have been inadequate.

THERAPY

Patients in whom coughing, shouting, laughter, or screaming precipitates asthma or in those children who have learned to turn on their asthma by deliberately hyperventilating or coughing or some other quirk they have accidentally picked up are prime examples where atropine by inhalation may be effective. Inhalation of atropine sulfate, in the correct dose for weight, will prevent asthma following these maneuvers, deliberate or otherwise. Inhaled atropine sulfate, adults 0.05 mg./K. to a maximum of 0.07 mg./K. per dose, three times daily and children 0.03 mg./K. to a maximum dose of 0.05 mg./K per dose three times daily, may be administered by a nebulizer using an air pump (such as the Maxi-Mist). In due time, some of the analogues of atropine (Atrovent) will become available using a freon-propelled inhaler. Others may follow.

CROMOLYN SODIUM

Cromolyn sodium occupies a unique position in the treatment of asthma. It is provided using a special inhaler (spinhaler) as a powder consisting of a lactose carrier base and 20 mg. of Cromolyn per dose. It is said to

provide its effects by stabilizing mast cell and basophil membranes, possibly by interfering with the calcium ion flux necessary to start the process of cell degranulation and mediator release. It is a very useful drug and has the following advantages:[8,9] it is very effective in blocking exercise-induced asthma in many but not all asthmatics, it appears to be an effective drug in seasonal, even perennial asthma, and side effects do occur but are easily reversible. Side effects may include bronchospasm associated with inhalation, transient hypersensitivity pneumonitis, and skin rashes.

Cromolyn is used two, three, or four times daily to prevent asthma (it is not a bronchodilator) as one inhalation about 5 to 10 minutes prior to sustained exercise to block exercise-induced asthma. There have been reports of its effectiveness by oral use, especially in systemic mastocytosis, although its use for this disease has not yet been approved. Nasal use in allergic rhinitis has received conflicting reports.[10]

AIR FILTERS FOR ASTHMATICS

Logic would suggest that air filters that remove allergenic irritative substances from household air should benefit asthmatics who are sensitive to these precipitants. Some facts need to be born in mind.[12] Any filter system that has an electric motor will produce ozone, a bronchial irritant that tends to cause bronchospasm. The size of the motor and its ability to move air rapidly from a room are important factors. A filter must pass all the air in the room through the room itself in a short period of time because if it takes many hours its worth will be nullified. The filter must remove and hold particulate matter which is in line with the size of the irritant. Most allergens are 15 microns and larger; many irritants may be around 5 microns.

Electronic plate filters. These systems work by utilizing charged plates through which air is drawn from the room air. Pollens and other particulate matter, having a different electrical charge, precipitate and are firmly held on a series of electrified plates. Most of these filters now have activated charcoal as part of the system to absorb any ozone that is released. The filter system is permanent and works efficiently for larger particles, but cleaning is a chore because electronic plates have to be removed and cleaned.

HEPA filters (High Efficiency Particulate Air Filters): Very efficient, these filters will remove particles even smaller than 5 micron in most cases. Cleaning is not required, but the filters clog up and have to be replaced at some expense after some months of use.

Electronic ionizers. These systems are supposed to work either by ioniz-

ing the particles with a different charge and hence attracting them to the room walls which have a different charge or, alternatively, that ionization of the air has a beneficial effect on asthma. Simple and noiseless, our own experience has been negative.

The first two filters may be effective if the room is sealed and the filter can turn over the air in the room rapidly (30 to 60 minutes). The shorter the time the better. It is essential that electronic plate and HEPA types be used in a room in which the door and all windows are closed for the night and no other source of forced air conditioning is present. Air entering the room from one small vent or similar source is of course necessary to supply air to the room but this small vent can be easily managed by the filters. It is also necessary for the subject to be sensitive to the allergens being excluded. Asthma predominantly due to nonallergic and nonirritant factors should not be expected to benefit.

All forms of treatment for asthma must be tailored to each patient. This is still as necessary as ever, over and above any filter being introduced.

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